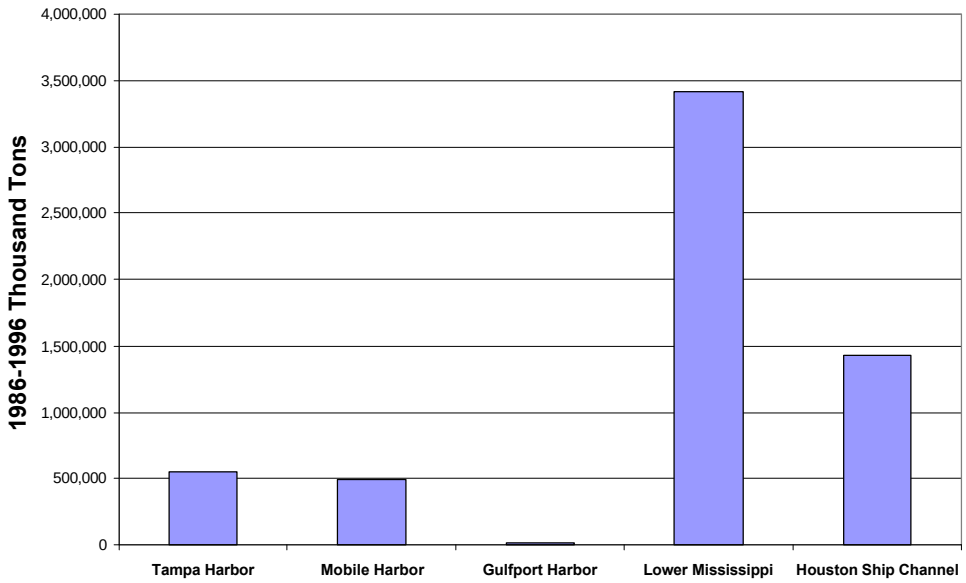
Conclusions of the Gulf of Mexico Ballast Water Profile

The ship traffic, cargo, and ballast-water data assembled and synthesized during this study reveal several Gulfwide and port specific statistics. It should be remembered, however, that the quality of these statistics is dependent on the source information used to create them. Before regulatory authorities use the following information in future nonindigenous species programs and regulations, the strengths and weaknesses of the source data and the data manipulations should be understood as fully as possible. Many data descriptors and qualifiers are described in the Methods section of this report. It would be wise to conduct uncertainty and sensitivity analyses, if supporting Gulf ballast water information is unavailable or contradicts the information is this report.

Figure 1. Tonnage 1986-1996 Cargo Traffic Among Five Gulf Ports (Tampa, Mobile, Gulfport, Lower Mississippi, Houston)



Proceeding on the assumption that this study was able to secure and use the best quality data presently available, several observations and comparisons can be made of the five port complexes reported herein. Probably the most readily apparent information among these five port complexes is that, collectively, a very large volume of cargo is shipped through the United States Gulf Coast. The Ports of the Lower Mississippi and Houston are major U.S. ports by any measure. In 1996, the three ports in the Lower Mississippi shipped 354 million tons of raw and finished cargo. Also, in 1996, the Port of Houston moved 146 million tons. Collectively, the five port complexes evaluated in this study shipped over 600 million tons in 1996. While this study did not quantify the values of the ship cargoes, it is conservative to assume that these five port complexes are major components of the regional and national economies. Furthermore, as shown in the individual port summaries, cargo volumes across the 5-port complexes have either increased or been steady over the last 10 years.

Figure 1 is a summary graphic of the 11-year cargo volume of the five ports. Total-cargo trend the Houston have experienced approximately 50 percent growth in the last decade, and each move several times the volume of cargo as the next largest port (*i.e.*,Tampa).

As discussed in the Methods section, because ballast water is a function of cargo volume and ship type, the number and types of ships calling on the five port complexes were also summarized in this study. Figure 4 is a three-dimensional representation of ship type and number (among bulkers, general cargo, and tanker) for the five ports in 1996. The same distributional data are also presented in two-dimensional format in Figure 5. Figures 4 and 5 show that the two largest numbers of ships, by category, in 1996 were general cargo ships calling on the Lower Mississippi and Houston Ship Channel, 711 and 385 ships, respectively. The fewest numbers of ships came to Gulfport, which received only one tanker and 14 bulkers in 1996.

Like the data presentations in preceding Figures 4 and 5, Figure 6 and 7 show cargo tonnages across the five port complexes, separated by ship type (*i.e.,* bulker, general cargo, and tanker). Salient features of 1996 cargo-tonnage summary is that the largest single category of cargo is bulker cargo in the Lower Mississippi (175.2 million tons). This is followed by tankers in the Houston Ship Channel (115.6 million tons), and general cargo in the Lower Mississippi (107.2 million tons).

From the data summarized in Figures 6 and 7, calculations were conducted to estimate total 1996 ballast discharged across the five ports and the three ship types. This information is shown in Figures 8 and 9. If one accepts the calculations and assumptions described in the Methods section, Figure 8 definitively demonstrates, by far, that the largest volume of ballast discharged in the Gulf coast ports is released by bulkers calling on the Ports of Lower Mississippi. However, this does not imply that other ballast releases from other ships or ports are inconsequential or of low volume. Figure 9 (with a log-scale x-axis) is composed of the same data as Figure 8. The log-scale date in Figure 9 shows significant volumes of ballast are discharged throughout the five ports and across all of the ship types. This is important relative to potential invasions of nonindigenous species into Gulf of Mexico ecosystems.

Figure 10 is a composite of the ballast release data in Figures 8 and 9. In Figure 10, ballast water releases are summed with ports in a single pie chart, showing that the Ports of Lower Mississippi account for 79.3 percent of ballast released in the five study ports in 1996.

In summary, the data evaluated in this study of five Gulf of Mexico ports shows that there are very large volumes of ballast releases occurring, and the vast majority of the releases are happening in the Lower Mississippi. Eleven-year trend data show that the volume of cargo shipped by sea throughout the Gulf is either level or steadily increasing. Current port expansions, and planned expansions, indicate that cargo tonnage, and by correlation ballast releases, are expect to increase yearly.

If the summary data in this report are accurate, efforts to limit or manage ballast releases should certainly include the bulker traffic in the Ports of Lower Mississippi. Unless there are new data or information to the contrary, most bulker traffic in the Gulf are participating in the U.S. export trade. That is, these ships usually enter into U.S. waters in ballast, and potentially with nonindigenous species aboard.

The descriptors of other ship traffic appear to be less certain. However, consideration of non-bulker traffic also is warranted, especially of modern container vessels that have sophisticated ballasting systems that continually manage onboard ballast volumes during transit and cargo handing for optimal safety and productivity of the vessel.

Finally, considerations should be given to the ecosystem in which ballast waters are released. For example, the Mississippi River is a generally fast flowing, freshwater, channelized river, with levees along much of its length. These parameters may make for a relatively inhospitable receiving environment for any biological hitchhikers. The contrary case may be evident in the Houston Ship channel, where the water flows are generally low, and the ship channel empties into Galveston Bay, a large embayment with many living resources and recreational amenities.

As described by Carlton *et al.,* and many others, the matrix of ballast volumes, sources of ballast water, shipboard transit conditions, and receiving environment conditions make for a complicated situation that is difficult to predict. However, there is general agreement that the large volumes of water arriving in the United States on dedicated international routes keep the "invasion window" open more often and for a longer periods than has occurred in previous history. To date, the subtropical environment of Gulf of Mexico ports is under studied with regard to invasions of nonindigenous species, but all indicators point to inevitable future invasions if current standards of ballast water management continue.

Figure 10. 5-Port 1996 Ballast Water Discharges
(Total Volume = 35.6 million metric tons/yr
8.6 billion gallons/yr, 16.8 thousand gallons/min)